Graphics Display of All Encodings of the (4!)^3 = 3,375 Mixed Nucleotide Codons

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The presence of mixed nucleotides within codons leads to multiple potential amino acid translations. In this work, we introduce a robust visualization approach that unravels this complexity, mapping mixed-nucleotide codons to their respective amino acid translations in a comprehensible manner. Utilizing our Mathematica graphic, users can quickly discern the potential amino acid translations of any codon, mixed or not. The visualization's intuitive design facilitates an appreciation of the organization of the genetic code.

Methods:

- Nucleotide Ambiguity Definitions: We first define a dictionary of mixed nucleotides, detailing the bases each can represent.
- Codon Expansion: For a given mixed codon, we generate all possible codon permutations based on the nucleotide ambiguity definitions.
- Codon Translation: Each possible codon from the expansion phase is then translated into its corresponding amino acid.
- Visualization Technique: A circular arrangement is employed to represent all 20 amino acids and stop in single-letter format.

Video: https://www.youtube.com/watch?v=_CFUwHkSuUU

Table: IUPAC Nucleotide Ambiguity Codes

IUPAC Code	Nucleotide(s) Represented	Description
A	Adenine (A)	Adenine
C	Cytosine (C)	Cytosine
G	Guanine (G)	Guanine
T (or U)	Thymine (T) or Uracil (U)	Thymine (in DNA) or Uracil (in RNA)
R	A, G	Purine
Y	C, T	Pyrimidine
S	G, C	Strong interaction
W	A, T	Weak interaction
K	G, T	Keto
M	A, C	Amino
B	C, G, T	Not A (B comes after A)
D	A, G, T	Not C (D comes after C)
H	A, C, T	Not G (H comes after G)
V	A, C, G	Not T (V comes after U/T)
N	A, C, G, T	Any nucleotide

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